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Although standard descriptions of spoken Brazilian Portuguese assign separate allophones to both /I/ and /u/ in utterance-final position after a vowel, it has been observed that in rapid speech native speakers articulate /I/ and /u/ in this position so that they are indistinguishable to the average speaker. To answer questions about the possible merger of phonetic norms, loss of phonemic contrasts, and syllable structure, an aural recognition test of minimal pairs was devised and spectrographic and fluoroscopic studies were made. The subjects were native speakers from the Cearense, Fluminense, Caipira and Sao Paulo dialect areas. Results of the preliminary aural recognition test proved inconclusive. The instrument tests showed a maximal differentiation between /I/ and /u/ in utterance-final position after a vowel revealed in the speech of the Sao Paulo and virtually all measurable distinction between /I/ and /u/ in this position was lost. It was concluded that utterance final /.CVu/ and /.DVI/ (stressed vowels) are characteristically realized as single syllables and that informants distinguish between members of such pairs as "mel"/"meu" on the basis of the nuclear vowel rather than any contrast in the final consonant. Suggestions are given for teaching these sounds to speakers of Spanish and English. (JD)

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RESEARCH REPORTS SERIES

Report #1

On Utterance-Final [ɣ] and [ũ] in Portuguese

David M. Feldman, Ph.D.
California State College, Fullerton
1968

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The Laboratory for Phonetic Research

The Laboratory for Phonetic Research was established in 1968 as a primary and supportive research facility of the Program in Linguistics at California State College, Fullerton. Its designer and director is Dr. David M. Feldman, who is also director of the Program in Linguistics.

Report #1

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I. Introduction

Standard descriptions of the overall pattern of contemporary spoken Brazilian Portuguese normally assign to the voiced alveolar lateral /l/ two allophones: [l] when initial or medial in syllables or when final in syllables immediately preceding a vowel in close transition; and [ɫ] when syllable final or when utterance-final.[1] The articulatory distinction between the allophones [l] and [ɫ] is characterized by retraction and absence or optionality of apico-alveolar occlusion in [ɫ].

Similarly, to the syllabic phoneme /u/ four allophones are assigned: [u] when stressed, except before /l/ in the same syllable; [ụ] when unstressed, except before /l/ in the same syllable; [U] when either stressed or unstressed before /l/ in the same syllable; and [u̯] unstressed after a vowel in the same syllable to form a diphthongal nucleus.

Thus, we would expect, in utterance-final position after a vowel to encounter the [ɫ] allophone as the realization of /l/ and the [u̯] allophone as the realization of /u/.

There is, however, a marked tendency in the rapid, unguarded speech of speakers of Brazilian Portuguese to articulate utterance-final /l/ and /u/ after a vowel so that they are indistinguishable from each other to the average hearer. Three questions immediately arise. First, have the phonetic

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[1] David M. Feldman, "Outline of a Comparison of the Segmental Phonemes of Brazilian Portuguese and American Spanish," Linguistics XXIX (1967) 44-57.

Robert A. Hall, Jr., "The Unit Phonemes of Brazilian Portuguese," Studies in Linguistics I (1943) 1-6.

David Reed and Yolanda Leite, "The Segmental Phonemes of Brazilian Portuguese," in K. L. Pike, Phonemics, Ann Arbor: University of Michigan Press, 1943, pp. 194-202.

norms of [ɪ] and [u̯] merged so that, in fact, no distinction is now made or perceived? Second, if such merging has taken place, are the utterance-final shapes now described as /-(c)V́l/ and /-(c)V́u/ to be considered no longer phonemically contrastive? Third, will this imply that formerly minimal pairs such as riu:rio, in which the first was traditionally viewed as monosyllabic and the second as disyllabic, are now exclusively monosyllabic?

Brazilian linguists and grammarians have long acknowledged the problem and have suggested that in rapid, unguarded speech any distinction between utterance-final /l/ and /u/ is, in fact, lost.

> O ([ɪ]) final é proferido relaxado, quase velar, mas tendo-se o cuidado de não fazê-lo igual a u.[2]

Similarly:

> . . . em posição pós-vocálica, porém [as líquidas] tendem a cair.[3]

In the study summarized below, answers to these three questions were sought.

Because our main concern has been to improve the detail of pedagogically-oriented phonological descriptions of Brazilian Portuguese, this presentation is limited to a summary of the results of the experiments and does not attempt to include a full statement of all the raw data nor to analyze in detail the research methodology employed.

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[2]Evanildo Bechara, Moderna gramática portuguêsa, Curso médio, 7ª ed., São Paulo: Companhia Editora Nacional, 1963.

[3]Sílvio Elia, Ensaios de filologia, Rio de Janeiro: Livraria Academica, 1963, p. 265.

II. The Experiment

Native adult informants, both male and female, from four major dialect areas of Brazil[4] were first asked to identify aurally a series of minimal or analogous-environment pairs designed to reveal potential contrasts between utterance-final [ɪ̯] and [ʊ̯] after a vowel.[5] No informant was able to identify correctly a sufficient number of isolated items taken from the pairs to suggest more than chance guessing as to which of the utterance-final phones was being used. In other words, the informants were unable to decide consistently or unanimously which word they were hearing when the component words of minimal or analogous-environment pairs, such as meu/mel, céu/(pin)cel, tal/tau, vil/viu, véu/(prová)vel, and sol/sou, were recited in isolation and in random sequence by native speakers via tape recording. This lack of uniformity in recognition was somewhat less prevalent when [ɪ̯] or [ʊ̯] occurred in interior syllable-final position, e.g., (farma)cêutico/céltico.

This confusion was all the more interesting because, in a pair such as vil/viu, the "ideal" realizations of the stressed vowels are [I] and [i], respectively, a clearly perceptible difference in Brazilian Portuguese.

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[4] The dialect areas represented, using the subdivisions proposed by Elia, op. cit., pp. 309-310, are:
a) área cearense (informant native of Fortaleza)
b) área fluminense (informants natives of Rio de Janeiro)
c) área caipira (informants natives of Bauru and Goiânia)
d) city of São Paulo (informants natives of the city of São Paulo)

[5] Here we use Kenneth Pike's distinction (Phonemics, pp. 73ff) between minimal pairs in which only one segment is in contrast and pairs which are not identical beyond the contrasting segment.

Four possible explanations of the phonemenon of aural confusion might be offered at the outset: (1) that the speakers modelling the utterances in fact made no articulatory distinction between /l/ and /u/ in the critical positions; (2) that although some articulatory differentiation was made, it was so slight that the hearers were unable to detect it systematically; (3) that utterances of this type in normal speech with /u/ as the final sound are always articulated as monosyllables; or (4) that the common tendency of speakers to replace the phonetic norm of some vowels with slightly lower variants when those vowels are followed in the same syllable by /l/ or /u/ affected in some measure the informants' recognition of the items, e.g., the [e] of farmacêutico vs. the [ɛ] of céltico. A simple election of one of these possible initial explanations was further complicated by the fact that some informants were able to recognize immediately some of the items modelled by some of the speakers when the minimal and analogous-environment pairs were read as pairs, suggesting that, at least for some speakers or hearers, the pairs were contrastive and not homophonic.

In this experiment, the minimal and analogous pairs used were both authentic and invented, the latter procedure being necessary because the language offers relatively few potentially minimal contrastive pairs of this type. Moreover, the primary basis of selection of pairs had to be based on orthography, since the phonetic data themselves were in question. Thus, the results obtained from the preliminary experiment could not be considered conclusive. Admittedly, not only did the authentic pairs tend statistically to be analogous rather than minimal, but it was also possible that the hearers' successful distinction between the utterances of some pairs was really based

on the recognition of cues contained in the utterances elsewhere than in the supposedly contrasting segments, e.g., in an open vs. close vowel preceding the syllable-final /l/ or /u/.

In order to resolve the problem, a more rigorously controlled second experiment was conducted. It was designed first to help pin down whatever acoustic and articulatory differences there may be between the two sounds in utterance-final position after a vowel; second, to examine the syllabic status of the /u/ in such utterances; and third, to suggest any possible need for revisions in existing descriptive statements regarding these articulations. For the experiment, a spectrographic study of the acoustic images of the realization of orthographic syllable-final l and u was followed by a limited fluoroscopic study of the same articulations. The undeniable significance of spectrographic information on certain features of the physiology of speech was made clear in 1951 by Pierre Delattre.[6] The decision to use limited fluorographic data in addition to the spectrographic information was for the purpose of gathering further information on the measurement of the oral and pharyngeal cavities.

In the spectrographic study, the target items were "hidden" in utterances of no more than 2.4 seconds duration and which always presented the target word in the final, and prosodically stressed, position[7]. Other utterances

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[6] Pierre Delattre, "The Physiological Interpretation of Sound Spectrograms," PMLA LXVI.5 (1951) 864-875.

[7] For example: Dê-me o meu vs. Dê-me o mel.

presented occurrences of /u/ and /l/ in other positions in order to provide a basis of comparison. The informants were unaware of the objectives of the experiment so that in modelling the utterances for the spectrograph as natural a quality of speech as possible was assured.

III. u: Preliminary observations

Allowing for expected variations in voice timbre among the several informants, the spectrographic realization of the /u/ in stressed and unstressed (both pre- and post-tonic) positions other than syllable final after a vowel was as expected. The lower formant averaged 322 while the upper approximated 740. The still-film records of the fluoroscopic study confirmed the corresponding articulatory features[8]:

1) Labialization: Sufficient construction of the orbicularis oris occurred to reduce the lip orifice to an average of 1.6 cm. but without significant protrusion.

2) Tongue position[9]: The dorsum was uniformly high. The apicum was characteristically lowered to the level of the base of the lower teeth, often retracted some distance behind the gums. A very slight convexity of the laminum was also noted.

3) Nasopharynx: firmly closed.

4) Epiglottis: almost vertical.

5) Pharyngeal cavity: Open, as observed by measurement of the cross-section of the pharyngeal cavity. Average width: 9.5 mm.

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[8] But because normal, unguarded speech was the desired norm for the modelling by informants, it was often difficult to pinpoint the precise moment at which the "characteristic" organic position of the articulation was achieved. Again, because of the admittedly pedagogical focus of this summary, the figures and tabulations presented must be viewed as having a relative, rather than an absolute, validity.

[9] Delattre, op. cit., has shown that the measurement of tongue height alone is less significant in the determination of sound production than the totality of the actual back-and-up tongue retraction. This feature, as we have also noted, is intimately linked to the lowering and retracting action of the lower jaw.

6) Jaw position: generally lowered without retraction; distance between upper and lower teeth averaged 1.2 cm.

7) Larynx: lowered.

8) Duration: average .141 sec.

When /u/ was articulated in unstressed utterance-final position after a consonant, no significant differences from the above were noted, save expected variations in the duration of the sound and in the microwattage of phonetic power.

Tracing of radiograph of [u]

When /u/ was articulated in unstressed utterance-final position after a preceding vowel, however, some significant changes were noted. The spectrograms revealed an average lower formant of 385, with a comparatively smaller change upward in the average higher formant of 950, suggesting a lowering of tongue height, but with only a slight tendency toward forward placement. The radiographs confirmed the following:

1) Labialization: slight, less than in [u] , no protrusion.

2) Tongue position: As in [u] , but with a slight lowering of the dorsum with slight fronting; laminum and apicum are not as forcibly depressed as in [u] , thus reflecting a change in the size of the anterior cavity.

3) Nasopharynx: Firmly closed.

4) Epiglottis: Angled in a lower direction with tendency toward posterior pharyngeal wall.

5) Pharyngeal cavity: Reduction in size from that of [u] averaging 2.5 mm.

6) Jaw position: slightly lower than in [u], but noticeably more retracted.

7) Larynx: slightly higher than in [u].

8) Duration: average .117 sec.

No significant departures from these general norms were noted among the informants.

Tracing of radiograph of [U]

IV. l: Preliminary observations

The Portuguese /l/ in absolute initial and interior syllable-initial positions is clearly a gingival lateral, unaccompanied by labialization or nasalization. The apicum makes a medial occlusion against the upper gums. The sides of the tongue are relaxed so that the breath stream flows between the teeth near the first premolars. The spectrographic realization of /l/ in these positions is as expected: showing the harmonic source characteristics of vocoids and the zeros in their spectrum envelopes characteristic of contoids. The lower formant averaged 250, below the lower formant of /u/. The upper

formant, however, varied consistently with the second formant of the adjacent vowel, e.g., c. 1200 when preceded by /a/, but with a high frequency spread reaching as high as 2000.

1) Labialization: insignificant

2) Tongue position: laminum elevated with tendency toward concavity; no corresponding elevation of the dorsum. The apicum is vigorously raised to definite gingival contact.

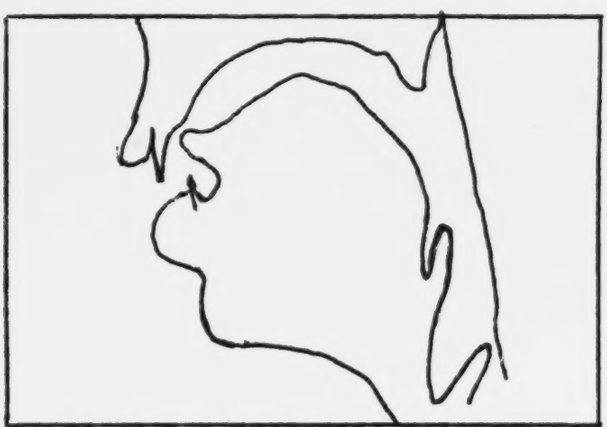
3) Nasopharynx: closed, with moderate sustained muscular pressure on the velum.

4) Jaw position: generally lowered with retraction; distance between upper and lower teeth averaged .75 cm.

5) Larynx: higher than in /u/

6) Duration: average .10 sec.

No significant departures from these general norms were noted among the informants.



Tracing of radiograph 1

When /l/ was articulated in utterance-final position following a vowel, however, significant changes are noted. Most notable, and consistent in all informants, is the elevation of the back of the dorsum of the tongue in the prevelar region, reflected in the spectrogram by a concomitant change in the frequency of the lower formant, with considerable lowering in the upper formant.

A. Informants from the city of São Paulo showed the following characteristics:

1) Labialization: slight; no protrusion.

2) Tongue position: humping of laminum with considerable elevation of the dorsum in the prevelar region. Apicum is held somewhat tensely, tending toward, but not achieving, gingival or alveolar occlusion. Occasionally, sufficient laxness of muscular tension occurs, permitting the lower surface of the apicum to contact the upper surface of the lower teeth.

3) Nasopharynx: vigorously closed, with sustained muscular pressure on the velum.

4) Jaw position: lowered and slightly retracted

5) Larynx: slightly lower than /l/ in syllable-initial position.

6) Duration: average .095 sec.

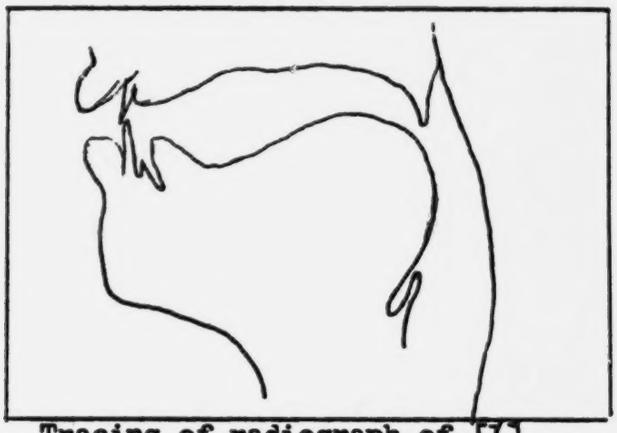
B. Informants from the interior of São Paulo state, however, differed in the following categories:

1) Labialization: none

2) Tongue position: humping of laminum with approximately the same degree of elevation of the dorsum in the prevelar region as in [u]; apicum held very tensely and raised toward alveolar occlusion in a majority of instances tested.

3) Larynx: slightly lower than for /l/ in syllable-initial position.

C. The informants from Fortaleza and Rio de Janeiro differed from groups A and B above in that the degree of elevation of the dorsum was greater and the apicum was lax, often assuming a low position behind the lower teeth.



Tracing of radiograph of [l]

V. Syllabic considerations:

In none of the pairs used in the experiment did informants create hiatus groups composed of the vowel followed by /u/. The unanimous tendency was toward diphthongization. In a test of the duration of utterances, measurements were recorded for all pairs. In the first run-through the form ending in orthographic l was first. In the second, the form ending in orthographic u was first. In the third, the pairs were mixed in random sequence. The average duration of the forms ending in orthographic l was .397 sec., while the duration of those ending in orthographic u was .454 sec.

Because we have noted that utterance-final /u/ after a vowel in utterances of the type we examined is treated as the coda of a falling diphthong rather than as a hiatic syllable, we feel justified in using the symbol [u] to represent it phonetically in the remainder of the discussion.[10]

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[10] This procedure is fully justified by the standard analyses of contemporary Brazilian Portuguese in which the pairs we have used are consistently listed as containing diphthongs as the final syllable. Cf., for example, Eduardo Pereira, Gramática expositiva, São Paulo: Companhia Editora Nacional, 102nd ed., 1957, pp. 26ff.

VI. Summary of comparisons of [l] and [u].

	[u]	[l]
1) Labialization:	rounding with minimal protrusion	no rounding or protrusion
2) Tongue position:	elevation of dorsum, lowering of apicum, gentle convexity of laminum	median position of dorsum, elevation and definite convexity of laminum, apicum raised to alveolar or gingival occlusion
3) Nasopharynx:	firmly closed, with sustained muscular pressure on velum	closed, but with only moderate muscular pressure on velum
4) Jaw position:	lowered (with an average of 1.5 cm. distance between upper and lower teeth); no retraction	lowered (with an average of .80 cm. distance between upper and lower teeth); slight retraction
5) Larynx:	lowered	slightly raised
6) Formant:	F_1 ave. 322 F_2 ave. 740 F_3 ave. 1200	F_1 ave. 250 F_2 consistently varies with second formant of adjacent vocoids F_3 ave. c. 2000
7) Duration:	average .141 sec.	average .10 sec.

The lower average of F_1 frequencies for [l] would indicate a generally smaller overall dimension of the oral tract than in [u]. This is confirmed by actual measurement in which the more posterior position of the dorsum and greater labialization in [u] creates a larger oral cavity volume than we find in [l]. Because of the difficulty in achieving a second formant for [l] in adjacency to a vowel, the evidence of formant 2 as an indicator of back-to-front tongue placement is not precise. The lowering of formant 3 in [l], however, clearly reflects the apical occlusion.

VII. Summary of comparisons between /l/ and /u/ in utterance-final position after a vowel

	MAXIMAL DIFFERENTIATION AMONG INFORMANTS[11]	
	[u̯]	[ɫ]
1) Labialization:	noticeable, but not intense, minimal protrusion	slight; no protrusion
2) Tongue position:	moderate elevation of dorsum, lowering of apicum, gentle convexity of laminum.	moderate elevation of dorsum, concavity of laminum, tense apicum but without occlusion
3) Nasopharynx:	firmly closed	firmly closed
4) Jaw position:	approximate average of 1.0 cm. distance between upper and lower teeth; no retraction	approximate average of 1.0 cm. distance between upper and lower teeth; retraction
5) Larynx:	lowered	very slightly lowered (higher than /u/)
6) Duration:	average .117 sec.	average .095 sec.

The consistently lower first formant in both sounds, as compared with [u] and [l] confirmed the generally smaller overall opening of the oral tract. The lower average of the second formant in [u̯] reflects the greater posterior placement of the tongue and the greater degree of labialization as compared with [ɫ]. The significantly lower third formant average of [ɫ], however, confirms the presence of at least the vestigial tendency to raise the apicum toward occlusion.

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[11] Revealed by informants from the city of São Paulo, the interior of São Paulo state, and Goiás.

MINIMAL DIFFERENTIATION
AMONG INFORMANTS[12]

	[u̯]	[ɫ]
1) Labialization:	very slight; no protrusion	very slight; no protrusion
2) Tongue position:	moderate elevation of dorsum; lowering of apicum to position behind lower teeth; gentle convexity of laminum.	moderate elevation of dorsum; lowering of apicum to position behind lower teeth; gentle convexity of laminum.
3) Nasopharynx:	firmly closed	firmly closed
4) Jaw position:	approximate average of .50 cm. distance between upper and lower teeth; slight retraction	approximate average of .50 cm. distance between upper and lower teeth; slight retraction
5) Larynx:	lowered	lowered
6) Duration:	average of .110 sec.	average of .110 sec.

VIII. Conclusions:

The articulatory and acoustic problems which underlie any attempt at a clear distinction between /l/ and /u/ in syllable-final and utterance-final positions are several. First, there is the basic problem of the "duality" of the liquid[13], bridging the vocalic and the consonantal, making /l/ unique among Brazilian Portuguese phonemes. Like the Brazilian Portuguese vocoids, /l/ is produced by vocal cord and varying cavity modulation. The lateral emission of the voiced breath stream, however, finds no parallel among Brazilian Portuguese vocoids. The second problem is that Brazilian Portuguese /l/ is one of the sounds most susceptible to the effects of assimilation. Thus, for example, we have no clear definition of second formant patterning,

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[12] Revealed by informants from Fortaleza and Rio de Janeiro.

[13] Roman Jakobson, et al., Preliminaries to Speech Analysis, Cambridge: MIT Press, 1957, p. 19.

since the second formant acquires most of the characteristics of the vowel sound which precedes or follows it. The third problem is that, in comparison with the other Romance languages, Brazilian Portuguese /l/ shows certain unique characteristics, among which we may note its marked tendency toward retroflexion of the apicum without necessarily achieving occlusion, convexity of the prelaminum, a lessening of the distance between the rear surface of the root of the tongue and the rear pharyngeal wall, and the tendency toward a slight construction of the orbicularis oris. We must add to this a general process of lenition of /l/ in contemporary Brazilian Portuguese which has caused Elia to remark that:

> O /l/ pós-vocálico está sofrendo um fenômeno de deterioração: ou se vocaliza, ou cai, ou se transforma na outra líquida o /r/ que . . . possúi maior vitalidade.[14]

In the Caipira dialect area, the substitution of /r/ for /l/ in the positions we have been discussing is attributed by many Brazilian linguists to an attempt to reach alveolar occlusion as in [l] but without lateral emission because of the speed of the articulation in the unstressed position. The result is an alveolar flap.[15] The phenomenon has also been attributed to the effects of African substratum or influence.[16]

In our comparison of [l] and [u], the above-mentioned characteristics of Brazilian Portuguese /l/ cause it to be less clearly different from /u/ in certain positions than in, say, French or Spanish. Still, labialization, tongue position, mandibular position, laryngeal height, and formant frequencies

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[14] Sílvio Elia, op. cit., p. 271.

[15] Ibid.

[16] Renato Mendonça, A influência africana, p. 120.

(to the extent that these latter are reliable in the case of /l/) provide us with the necessary acoustic and physiological data to predict and account for a clear differentiation between [l] and [u] from both the speaker's and hearer's points of view.

In our comparison of [ɻ] and [u̯], however, we note much greater dialectal divergences. In general, there is a clear tendency toward an equalization of acoustic and physiological phenomena between the two sounds even in those informants whose idiolects retain the distinction in utterance-final position after a vowel. First, even in the informants from São Paulo and Goiás with regard to labialization, the [u̯] shows a lessening of constriction of the orbicularis oris when compared to [u], while [ɻ] shows an opposite tendency toward constriction when compared with [l]. Thus, the two articulations [ɻ] and [u̯] are significantly more alike than are the articulations [l] and [u]. In these idiolects in which the distinction is in any way preserved, the [u] is articulated with a noticeable lowering of the dorsum as compared with [u], while the [ɻ] shows a similarly noticeable raising of the dorsum as compared with [l]. The convexity of the laminum in [u̯], however, is distinct from the concavity of the laminum in [ɻ]. The lax apicum in [u̯] is likewise distinct from the tense and raised apicum in [ɻ]. The major feature here is the distinction between apical position in [l] and in [ɻ]. In the case of [ɻ], however, the apicum is tense and raised, but fails to make any occlusion with the upper surface of the oral cavity. In the case of the informants from Rio de Janeiro and Fortaleza, however, virtually all measurable distinction between utterance-final /l/ and /u/ after a vowel is lost. Thus, when compared in terms of apical position and convexity of the laminum, [l]

and [u] are distinct, while [ɪ̯] and [u̯] merge. Likewise, in the case of these particular informants, with regard to mandibular movement, [u̯] and [ɪ̯] show a virtually equal degree of tensing and retraction.

It is clear, then, that the essential distinctions between [l] and [u] are considerably reduced in [ɪ̯] and [u̯] in the overall pattern, leaving basically only the tongue position and mandibular retraction to make the distinction. In the speech of Carioca and Ceará informants, as we have seen, no significant distinction is made.

Apparently some speakers of Brazilian Portuguese tend to increase the constrictive movement of the orbicularis oris in the articulation of [ɪ̯], making in fact a rounded vs. unrounded distinction in the articulation of [l] vs. [ɪ̯] while the apicum remains lax and low behind the lower teeth. In our observations, the greater the degree of increased labialization, the less the degree of tenseness in the apicum. Thus, many speakers, in effect, substitute a slight labialization for apical occlusion in the articulation of [ɪ̯]. Simultaneously, there is a tendency toward relaxation of apical tenseness, permitting a greater degree of mandibular retraction. Consequently, the apical position is more fully differentiated from [ɪ̯] to [l].

These observations account in great measure for the inability of the informants to distinguish aurally between utterance-final [ɪ̯] and [u̯] in minimal pair situations. But we still have not accounted for the possible effect of a preceding close or open vowel on such aural comprehension in analogous-environment pairs such as meu/mel ([méu]/ [mɛ́ɪ̯]). Both meu and mel derive from Popular Latin etyma with /ɛ/: mĕum and mĕl(lis), respectively. /mĕl/ > /mɛ́l/ is the expected development, while the raising of the /ɛ/ in

meum to /e/ in meu was occasioned by the hiatic continguity of a high vowel in the following syllable.[17] On the other hand, if our observations of a merging of [u̯] and [ɪ] are correct, then we must take into account any potential assimilative influence of [ɪ] on the preceding vowel. The influences of final /l/ on preceding vowels have been demonstrated graphically by Potter, et al.[18] The second, third and fourth formant bars of /ɛ/ followed by /l/, for example, are pulled sharply downward to join with the corresponding formant bars of /l/. The same occurs to the second and third formant bars of /ɛ/ (the fourth bar for [ɛ] was not realized clearly on any of our spectrograms) when followed by /l/. The influence of /u/ on a preceding /e/ or /ɛ/ is even more severe. Thus, to articulate a tense /e/ before [u̯], as in meu, without lowering the /e/ to /ɛ/, requires a much greater muscular effort with regard to the /e/ followed by /u/ than for /ɛ/ followed by /l/.

This extraordinary reinforcement of the tenseness of /e/, in which the characteristic apical position is low (behind the lower teeth), would tend to impede the raising of the apicum and the tensing of its muscular structure in rapid transition. To test the hypothesis that accurate aural recognition of mel vs. meu depends upon the /e ~ɛ/ contrasts and not upon an /u ~l/ contrast, the artificial pairs *[méɪ] and *[méu] were recorded. The native informants were unanimous in recognizing the first as the possessive meu and the second as the noun mel, despite the reversal of the final sounds.

We may conclude that utterance final /.CV́u/ and /.CV́l/ are characteristically realized as single syllables. The experiment revealed that, when utterances

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[17] C. H. Grandgent, An Introduction to Vulgar Latin, Boston, 1908, secs. 347, 385.

[18] Ralph Potter, G. Kopp, and H. Kopp, Visible Speech, New York: Dover, 1966, pp. 236ff.

of the /CV́u/ type were read as /CV́l/ (and conversely), informants consistently selected the correct utterance on the basis of the nuclear vowel or the initial consonant (or both), but not on the basis of any contrast between the final [ɫ] or [u̯].

In narrow transcription, then, for the description of overall pattern the separate symbols must be retained. The acoustic and articulatory data referred to above are sufficiently distinct in [ɫ] and [u̯] for the generalized pattern covering the several dialect areas represented to require the retention of separate symbolism. But for the informants from the cearense and fluminense dialect zones, the only realization of unstressed utterance-final /l/ or /u/ after a vowel is [u̯] and, consequently, only one symbol is required even in narrow transcription.

At the level of broad transcription, however, the issue is less clear. When informants heard *[mɛ́l] or *[mɛ́u] as substitutes for mel, they invariably chose the latter as the form closest to any they had ever heard or said themselves. The former was understood, of course, but sounded "oratorical" or, in some cases "foreign".[19] From the viewpoint of the hearer at the phonemic level, then, a convincing case can be made for the assignment of [ɫ] and [u̯] as allophones of /u/ in the overall pattern in dialectally-determined variation. The same would be true of the phonemic analysis from the speaker's viewpoint, in overall pattern. However, for those dialect areas in which the apical distinction between [ɫ] and [u̯] is revealed, the articulatory features appear still to be sufficiently consistent and distinct to warrant their respective assignments to /l/ and /u/ in descriptions of the respective idiolects. The monosyllabic realization of both the /CV́u/ and /CV́l/ types, moreover clearly implies the need for revision of present descriptions of Brazilian Portuguese falling diphthongs.

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[19] Cf. the sociological generalization by Antenor Nascentes, O linguajar carioca, Rio de Janeiro: Simões, 1953, p. 48: "O l final é pronunciado levemente pela classe culta; os pedantes exageram-no...."

For pedagogical purposes, the approximation of [ɫ] and [u̯] can be subjected to more thorough treatment in teaching materials than has been the case. English- and Spanish-speaking students, in the transfer of phonetic habits into Portuguese, tend to hear the utterance-final l and u as the same sound. When the word is cognate with an English and Spanish form (or when the student sees the written representation of it) the learner then substitutes /u/ or /l/. Because both English or Spanish have falling diphthongs of the /-.V́u#/ type, students have less trouble articulating a native-sounding [u] than [ɫ], especially after a clear demonstration and sufficient repetition drill. But because neither the Spanish /l/ after /a/ nor the English "dark" /l/ achieves the vocoidal characteristics of the Portuguese [ɫ], it seems more economical to treat the syllabic structure /-.V́u#/ and /-.V́l#/ as consistently ending in [u̯].

Appendix

Partial inventory of minimal pairs

1. [e] u vs. [ɛ] l

meu	mel
-cêutico	céltico
o teu	hotel
mareo	chairel

2. [ɛ] u vs. [ɛ] l

céu	cel(ta)
véu	(prová)vel

3. [a] u vs. [a] l

tau	tal
cacau	chacal

4. [o] u vs. [ɔ] l

sou	sol
vou	(fute)bol

5. [i] u vs. [I] l

viu	vil

6. [i] u [i] l

tio	til

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